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STUDY OF THE RMB EXCHANGE RATE'S IMPACT ON THE CHINESE STOCK MARKET

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ABSTRACT

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Since the 1970s, with the implementation of a floating exchange rate regime in the worldwide, the foreign exchange market and the stock market have drawn more and more attention from scholars at home and abroad. It becomes crucial to probe the influence of exchange rate variations on the stock market in depth with the liberalization of capital markets.

Therefore, this paper took the influence of exchange rate fluctuations on the stock market as the main body, through reviews of the mainly literature on this topic, the interaction existed between exchange rates and share prices, and an introduction of transmission mechanisms and other related theories, combined with empirical analysis methods, analysis and a summary of the effect of exchange rate variations on China's stock market are also presented.

Finally, based on the result of empirical analysis, the conclusions are put forward followed by several related recommendations. In the long run, these two variables of exchange rate and share price are not cointegrated. From the perspective of short-term relations, the Granger causality between two variables is one-way, which is from the exchange rate to the stock price.

Keywords Exchange rate fluctuation Stock Market Impact

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1 INTRODUCTION

1.1 Research background and significance

In the 1970s, due to declining gold reserves, the balance of payments in the United States had a serious imbalance which coincided with the outbreak of the oil crisis. These factors led to the Bretton Woods system, which was established after the Second World War, to be withdrawn from history three years before the Nixon administration fell. The gold exchange standard system based on gold and dollars has gradually begun to change into the floating exchange rate system based on market supply and demand. It has not only been accepted and used by most countries, but has also achieved a legal status worldwide.

Since 2005 China has gradually implemented exchange rate reform measures and established a floating exchange rate system. This system is based on the basis of market supply and demand referring to monetary policy. Since then the renminbi exchange rate has used a basket of currencies as the calculation standard, which has changed the history of the renminbi exchange rate being manipulated by the US dollar. After the exchange rate reform, the renminbi has been showing a steady rising trend. In the beginning of 2018 the exchange rate of RMB against the U.S. dollar reached 6.3489. In the same period the Chinese stock market was quite turbulent. The Shanghai-Shenzhen 300 rose from 941.428 points on 4/1/2006 to 6/10/2007, reaching the highest point of 5,878.202 points. Subsequently, the stock market began to decline, reaching a new low of 1,627.759 points on 4/11/2008. Since then, the stock market has continued to oscillate. As of 25/4/2017, the Shanghai and Shenzhen 300 Index reached 3,440.974 points. Chinese stock market is still in a weak and volatile situation at this moment. According to international experience, when the exchange rate fluctuates, it often brings shocks to the stock market. The connection between the exchange rate market and the stock market has always been of concern to scholars in various countries. With the opening of the capital market, it has become crucial to thoroughly explore the impact of exchange rate changes on the stock market.

By studying the current Chinese economic environment and absorbing relevant domestic and foreign research results the impact of exchange rates on the stock market can be clarified. This will include empirical tests and analyzing the impact of the foreign exchange market on the stock market from numerous data. This study is of significance

in promoting a steady and healthy development of China's stock market, and also promoting the opening of China's capital market.

1.2 Research content and methods

1.2.1 Research content

This article includes five major sections. The first chapter is the introduction, mainly discussed are the research background and the significance of the research. It also gives a general introduction to the research content and the specific methods used in this article. The second chapter is the literature review. It summarizes the current research in various countries on the subject. The third chapter analyzes the relationship between the exchange rate and the stock price. Firstly, it introduces two classical models with high recognition by scholars, in various countries. Next, it briefly analyzes how the transmission mechanism works. The fourth chapter empirically tests the time series data of the exchange rate and the time series data of the Shanghai and Shenzhen 300 Index and conducts a deep analysis of the experimental results obtained. The fifth chapter puts forward several relevant suggestions based on the conclusions drawn from empirical analysis.

1.2.2 Research methods

In terms of research methods, an approach that combines theoretical analysis and empirical analysis is used in this paper. Firstly, the basic model between the exchange rate and the stock price is introduced and analyzed, and on this basis, the possible transmission mechanism between the two is proposed. Then, through the selection of research variables for the renminbi exchange rate against the US dollar and the CSI 300 Index, an empirical analysis of these two research variables is conducted by adopting the method of econometric analysis. Based on the obtained argumentations, the recommendations of this paper are proposed.

2 LITERATURE REVIEW

2.1 Foreign Literature Review

Since the early 1980s the relationship of interaction between the stock market and the foreign exchange market has attracted more and more attention of scholars. So far, although there are many research documentations, there are still many differences in the conclusions drawn due to the diversities in country selection and measurement methods.

A simple regression was performed through the monthly data on the share price and the effective exchange rate in the United States from 1974 to 1978, and Aggarwal (1981) concluded that a clear positive correlation existed between the USD exchange rate and the overall rate of return on the stock market. On the contrary, Soenen and Hennigar (1988) drew the conclusion that a significant negative correlation was shown between the exchange rate and the share price by analyzing the monthly share price of the U.S. multinational corporations and the monthly exchange rate of USD from 1980 to 1986.

After multiple regressions based on exchange rate, interest rate, inflation expectation, and securities price, Solnik (1987) found a weak correlation between exchange rate movements and stock market prices.

Mao and Kao (1990) reached the conclusion that the impact of fluctuations in exchange rates on share prices varies according to the economic level of each country. For example, for import-oriented countries, currency devaluation was quite unfavorable to the economic development of the entire country. On the contrary, for export-oriented countries, it was beneficial.

Bahmani-Oskooee and Sohrabian (1992) found that although a two-way Granger causality between exchange rate and share price existed, a long-term balance was not noted between the two variables.

Granger, Huang, and Yang (2000) conducted Granger causality tests on seven countries that were hit by the Asian financial crisis by using the daily data from 1/3/1986 to 14/11/1997. The result of the research showed that a bidirectional Granger causal-effect relationship existed in the South Korea, the Philippines, Indonesia, and Malaysia,

unilateral Granger causality existed in Japan and Thailand. However, no Granger causality was found in Singapore for exchange rate and share price.

Muhammad and Rasheed (2002) conducted empirical research according to the monthly data of the stock market and exchange rate from 1994 to 2000 on four countries in South Asia: Pakistan, India, Sri Lanka and Bangladesh. Research showed that in Pakistan and India, the exchange rate would not be influenced whether operating long-term stock market or short-term stock market. However, in the other two countries, a bidirectional Granger causality was shown between the stock market and exchange rate.

Both Vardar (2008) and Kasman (2011) considered that exchange rate and interest rate were the most important economic and financial variables that affect a company's stock price. Hyde (2007) and Lin (2012), through empirical research, found that exchange rate fluctuations not only influenced the cash flow of import and export companies, but also had a significant impact on purely domestic firms.

2.2 Domestic Literature Review

Before China implemented the exchange rate reform in 2005, the RMB exchange rate was entirely based on the US dollar and was a single fixed exchange rate system. Therefore, the time for studying the relationship of the exchange rates and share prices in China is relatively short. Below is a summary of the research on this issue:

Chen Ranfang (1999) believed that the impact of the exchange market on the stock market in China was relatively small, and there was no obvious link between the two. This phenomenon was mainly due to China’s exchange rate having not achieved marketization, the capital account had not completed the free exchange, and reasonable stock price formation mechanisms had also not been established.

Jiang Li and Wang Wei (2003) analyzed the impact of the appreciation of the renminbi on China's stock market from a theoretical perspective and believed that the appreciation of the renminbi had both beneficial and disadvantageous effects on the stock market. The main advantage was the appreciation of the renminbi potentially accelerating the internationalization of the Chinese stock market, and the expectation of the appreciation could lift the stock market price level. The main disadvantage was that the international capital inflow caused by the appreciation of the renminbi might destabilize the

development of the financial market and affect the independence of the monetary policy to some extent.

Long Shanhu and Fan Zuojun (2006) conducted empirical tests and observed that the stock share index had a cointegration relationship with the exchange rate of RMB against USD, and there was a negative relationship between the two, in that the appreciation of the renminbi could drive up the stock price.

Deng Ji and Yang Chaojun (2007) tested the cointegration relationship by using the daily data of the average rate between RMB and USD and the closing price of the Shanghai Composite Index. The results showed that the two variables are long-run equilibrium. And then the Granger causality was tested based on the VAR model and VEC model. The conclusion obtained from this test is consistent, namely from the exchange rate to the share price, the Granger relationship is one-way.

Ba Shusong and Yan Min (2009) used the daily data from 22/7/2005 2005 to 31/10/2008 to conduct research, they used the middle price of Yuan against USD as the exchange rate indicator and SSE Composite Index as the share price indicator. The sample interval was divided into four parts, and the Chinese-American differential spread was introduced as an exogenous variable in constructing the vector autoregressive model. The results showed that only in 2006 a long-run equilibrium relation for the two variables existed. But in 2005, 2007 and 2008, the two variables did not show a long-term equilibrium.

Zhou Huqun and Li Yulin (2010) conducted research with a specific economic background. During the period of international financial crisis, the exchange rate of RMB and the SSE Composite Index were used as indicators. Different lag periods were selected to examine the Granger causality. The finding of the research showed that there was no two-variable Granger causality found.

Liu Bao and Liu Xin (2011) used a one-year NDF of Yuan against USD and SSE Composite Index as indicators representing two variables to construct a vector autoregressive model and perform cointegration test on account of this model. It turned out that a long-run equilibrium existed between the two variables.

Xing Liwen (2014) also studied the daily data. The selected period was from 4/30/2010 to 4/30/2014. Taking the middle exchange rate of Yuan against the USD and the SH Index

as the indicators of exchange rate and share price respectively, the test in practice showed that a long-run equilibrium relation for the two variables was yielded, and the two variables showed a two-way Granger causality in the short term. Moreover, from the degree of influence, the impact of share prices on the exchange rate was more pronounced.

3 THEORIES OF INTERACTION BETWEEN EXCHANGE RATE AND STOCK PRICE

3.1 Basic Theories of the Relationship for Exchange Rate and Stock Price

There are two mainstream viewpoints in the theoretical community regarding what kind of relationship exists between exchange rate and share price. One is a flow-oriented model determined by the exchange rate based on the micro-level. The other is a stock-oriented model that prevails at the macro-level.

3.1.1 Flow-oriented model

The flow-oriented model was proposed by Dornbusch and Fisher in1980. This model put emphasis on the relevance between exchange rate and current account, and the important role of asset accumulation in current-account. When the exchange rate of a country changes, the country's international competitiveness will change, which will affect its international trade balance and actual output, and the stock market will change accordingly. (Dornbusch et al. 1980.)

The model mainly analyzes the matter from a micro perspective, and believes that when a country's exchange rate fluctuates, the actual profitability of micro-enterprises in the country will be influenced, and then affect companies' cash flow. This effect occurs through two approaches.

The first approach is as follows: if the partial or whole assets and liabilities of the micro-enterprises are quoted in other currencies, the value of these assets and liabilities will vary as the exchange rate changes. Taking the direct price method as an example for analysis, when the exchange rate rises, it means the devaluation of the local currency. As this happens, the company's liabilities in foreign currencies will increase, and the company's profits and cash flows will decline accordingly. However, the assets of foreign companies that are priced in foreign currencies also will increase, and their profits and cash flows will ascend accordingly. The final comprehensive impact depends on the value of the assets and liabilities priced by foreign money of the company.

The second way this effect has influence is as follows: exchange rate changes will affect the micro-enterprises' import and export trade business, taking the direct price method as

an example, too. For enterprises with export-oriented businesses, as the exchange rate rises the local currency will devaluate. In the international market, the prices of goods and services exported by enterprises have declined and become more competitive. As demand rises, the company's export revenue rises, and profits and cash flow also rise. For enterprises with import-oriented businesses, a rising exchange rate and the devaluation of the local currency causes the price of raw materials imported by other companies in the international market to rise. As corporate import costs rise, profits and cash flow also fall.

Although the price of an enterprise's stock is affected by various external factors, it is ultimately determined by the intrinsic value of the stock. The intrinsic value of stocks, generally, can be obtained by summing up the cash flow claims of the company in the future. When the change of exchange rate causes the cash flow of the company to change, the intrinsic value of the company's stock also changes with it, which in turn affects the stock price of the company. (Zhang et al. 2008.)

3.1.2 Stock-oriented model

Branson (1983) and Frankel (1983) proposed a stock-oriented model which analyzes matters from the macro perspective and emphasizes the important role of capital and financial accounts. When a country's stock price changes, such changes are transmitted through capital projects, it ultimately will affect the price of the country's currency. (Branson 1983; Frankel 1983.)

The model believes that rational investors will choose the optimal portfolio for themselves based on their investment returns. When the return of an asset changes, investors will adjust it to reshape to the optimal portfolio. Once investors begin to adjust, the demand for domestic currency may change. Take the rise in stock prices as an example, when a country's share price rises, it will affect both foreign investors and domestic investors. Foreign investors will increase their capital investment in the domestic stock market. As a result, foreign investors' demand for local currency will increase. At the same time, domestic share prices will rise, which will increase the wealth of domestic investors, and domestic investors will also raise their needs for currency. With the contribution of these two kinds of needs, the demand for local currency will increase, making domestic interest rates rise. Further to this, domestic and foreign interest spreads widen, further attracting foreign investors, and foreign investors' demand for local

currency will also be further expanded. Driven by various factors, the rise in domestic share prices will cause the growing in domestic currency needs. In the same way, if the stock price of the country falls, foreign investors will withdraw from the local market and reduce the needs for local currency. Local investors will also reduce their demand for money because of the decrease in wealth, and their demand for domestic currency will decline. (Chen 1999; Fan et al. 2006.)

The stock-oriented model assumes that the currency is the same as a general commodity, therefore, the supply and demand determine its price. From the above analysis, we can see that the stock price rose and the demand for local currency rose, which led to the appreciation of the local currency. Under the direct quotation method, the exchange rate dropped. When this change is in the opposite direction, the reverse is true.

3.2 Transmission Mechanism Between Exchange Rate and Stock Price

The fluctuation of exchange rate cannot directly lead to variations in share prices. Their impact on stock prices is indirect and they need to be transmitted through a series of economic variables. This article analyses and clarifies how exchange rate changes interfere the share price through rate of interest, money supply, import and export trade, and short-term international capital movements and psychological expectation.

3.2.1 Interest rate

In the actual economic operation, if the interest rate changes, there are several ways to transfer this change to the stock price (Dong et al. 2007).

Firstly, changes in interest rates will change the cost of borrowing. Taking the rise in interest rates as an example, when the interest rate rises, the cost of corporate loans will increase. Under this circumstance, the production scale of the enterprise will be reduced accordingly, and the profit will be reduced, causing the stock price to fall.

Secondly, changes in interest rates have changed the investor's required return on investment. When the interest rate of a country rises, the interest rate in the money market rises. Even if the risk premium does not change, the rate of return required by investors consisting of the sum of the money market interest rate and the risk premium will also rise, causing the stock price to fall. In the case of a falling stock price, the level of investor risk aversion will increase, and the risk premium will also rise. As this happens, the

required return on investment will increase further, and the magnitude of stock price decline will also increase.

Thirdly, changes in interest rates will produce asset substitution effects. When interest rates rise, some investors will adjust their asset portfolios, withdraw funds from the stock market, and invest in bonds and bank savings. Demand for stocks has been reduced, causing prices to fall. (Gordan 1959; Wang 2003; Li et al. 2007.)

To sum up, changes in exchange rates can trigger changes in stock prices through interest rates. The transmission mechanism is shown in Figure 1.

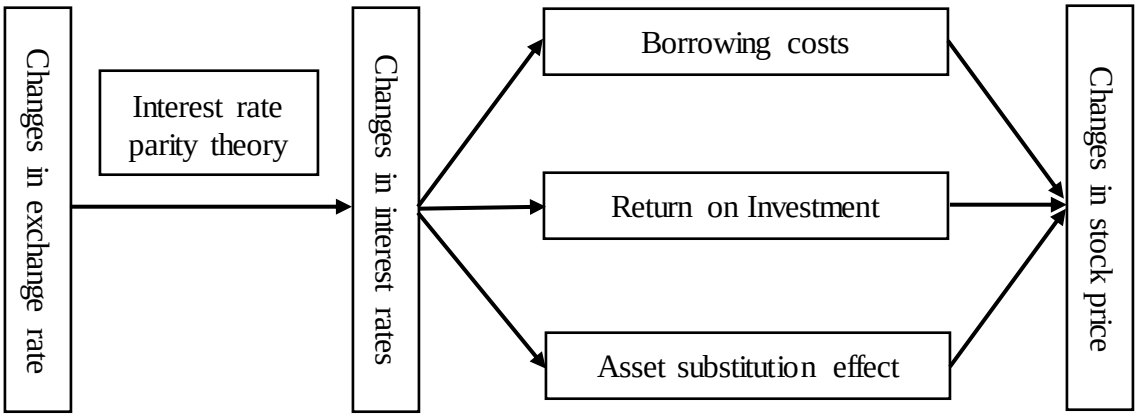

Figure 1. Transmission mechanism based on interest rate

3.2.2 Currency supply

Currency supply is a significant mediator variable in the operation of monetary policy, the same as interest rates. When the foreign exchange market has undergone dramatic fluctuations, the monetary authorities of a country will intervene in the foreign exchange market, especially countries that adopt a fixed exchange rate regime or countries with administered exchange rate policy. (Huang 2012, 23-28.)

If there is a devaluation pressure on the exchange rate of a country, the currency management authority can reduce the domestic currency supply, increase the needs for local currency, and reduce the depreciation pressure of the local currency by purchasing local currency and throwing foreign currency. In the same way, if there is a pressure for exchange rate appreciation, monetary authorities will buy foreign exchange, increase the supply of local currency and reduce the demand for local currency, thus reducing the pressure for appreciation.

When the money supply changes, there are two ways to transfer this variation to the share price. The first one is the income approach. When the money supply rises, the demand for consumption and investment will rise accordingly, which will increase the level of national income and further stimulate consumption and investment and part of the increased investment will inevitably flow into the stock market. In this situation, the demand for shares has increased, which has pushed up the price. The reverse is true, too. The second approach is the price approach. When the money supply rises, the overall price level of the society will ascend, which will lead to the increasing of corporate profits and share prices accordingly, and vice versa. (Jiang 2004; Tu 2011.)

The exchange mechanism of exchange rate fluctuations caused by the supply of money due to stock price movement is shown in Figure 2.

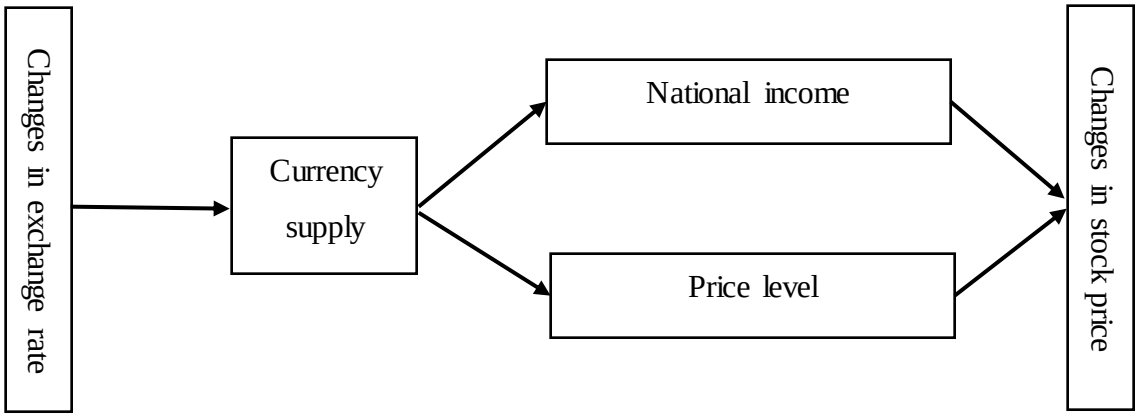

Figure 2. Transmission mechanism based on currency supply

3.2.3 Import and export trade

When enterprises engage in import and export trade, fluctuations in the exchange rate will influence trading volume of import and export trade, which in turn will cause variations in corporate profits and share prices.

For enterprises with exports as their main business, the appreciation of their currencies means that when exchange rates fall under the direct quotation method, the prices of products produced by enterprises will increase in the international market, the competitiveness of products will decline, the export revenue of enterprises will decrease, and profits will decline, leading to the price of corporate stocks dropping. On the contrary, when the currency depreciates, the company's export revenue increases, and the stock price rises accordingly. For enterprises whose raw material sources are mainly import-

oriented, the appreciation of their currencies leads to the cost of importing raw materials in the international market falling, the cost of enterprises fall, profits rise, and the stock price also rises. In the devaluation of the currency, the principle of the various changes is the same. (Feder 1982; Yao 2001; Xu 2008.)

Changes in exchange rates have caused changes in the import and export trade of enterprises, which in turn has caused changes in the stock prices of listed companies. The transmission mechanism is shown in Figure 3.

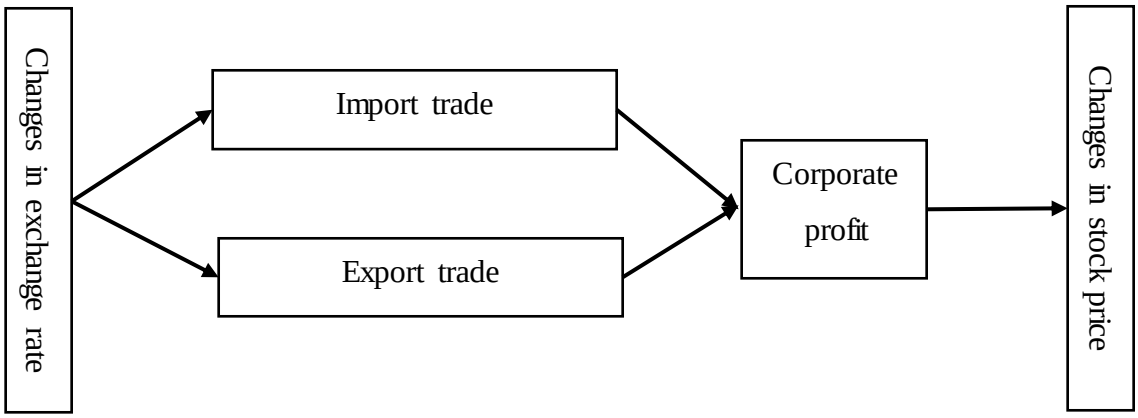

Figure 3. Transmission mechanism based on import and export trade

3.2.4 Short-term international capital

Short-term international capital is generally regarded as highly speculative, with the goal of pursuing high returns. When a country's currency appreciates, that is, if the exchange rate falls under direct quotation and if international investors expect their currencies to appreciate further, then short-term international capital will flow into the country for arbitrage purposes. (Yun 2009, 1-6.)

Short-term international capital inflows can affect stock prices through two channels. The first channel is short-term international capital flowing directly into the stock market, resulting in an increase in demand for stocks, which in turn increases stock prices. The second channel is the inflow of short-term international capital making the country's money supply increase accordingly, causing the interest rate to decrease. It is known from the Gordon model that the decrease of interest rate will cause the stock price to rise. The rise in stock prices will further attract international investors, increase the pressure on the appreciation of the local currency, and promote a further rise in the stock price. Under the combined effects of various factors, it is very easy for the stock price to rise irrationally

and form a bubble. When investors expect no more appreciation of the local currency or see signs of devaluation of the local currency, short-term international capital will quickly flee, and even some domestic capital will follow international capital flows abroad. As this occurs, it is extremely easy to form a phenomenon of stock price crash, and it further stresses the devaluation pressure of the local currency. (Ji 2004; Chen 2012.)

The transmission mechanism is shown in Figure 4.

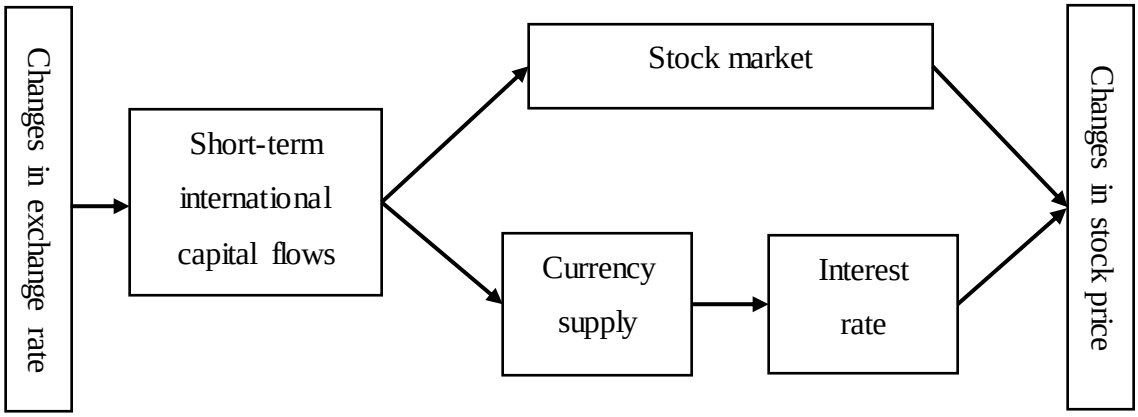

Figure 4. Transmission mechanism based on short-term international capital

3.2.5 Psychological expectation

The exchange rate, like other commodities, fluctuates due to people's expectations, and this expected effect is sometimes more significant than economic factors. When investors expect a certain currency to be undervalued, they rush to obtain the benefit of future appreciation of the local currency, this creates an excess demand for the currency, pushing up the exchange rate of the currency. When market participants believe that a currency value is overvalued, in order to avoid the risk of devaluation of the local currency in the future, an excess supply of the currency will be formed, and the exchange rate of the currency will be depressed. (Hirshleifer et al. 2003.)

When investors expect the exchange rate to change, they will also consider changes in the basic domestic economic conditions caused by exchange rate fluctuations, and thus continue to adjust the portfolio of assets held, and ultimately affect the stock price (Zeng 2012). As shown in Figure 5, the exchange rate uses psychological expectations as an intermediary to influence the transmission mechanism of stock prices.

However, the capital account in China has not been completely liberalized, and marketization of exchange rate and liberalization of interest rate are still in the process of advancement. These factors will, to a certain extent, restrict the use of economic variables such as interest rates as a function of the transmission pathway. In the following section, this thesis will examine China's actual economic background to analyze how the RMB exchange rate changes affect Chinese overall stock price through empirical tests.

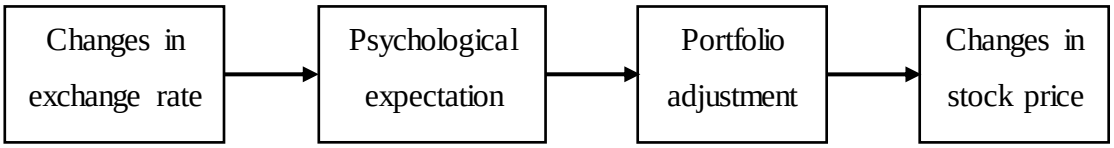

Figure 5. Transmission mechanism based on psychological expectation

4 EMPIRICAL ANALYSIS

4.1 Vector Autoregressive Model Introduction

The famous scholar Christopher Sims creatively proposed a vector autoregressive model, which is abbreviated as the 'VAR model'. Under normal circumstances, the VAR model is widely used as an econometric model. Under this model, all the current variables need to be regressed to some lagged variables of all variables. In this way, the dynamic relationship of joint endogenous variables is estimated. This model is most widely used in current economic development. (Sim 1988.)

The VAR model takes $y_t = A_1 yt_{t-1} + ... + A_N y_{t-N} + Bx_t + \varepsilon_t$ as an expression. This model means that each equation in the system has the same variable to the right side of the equal sign. If each variable contributes to the remaining variables, this series variables is appropriate to be expressed by the VAR model. The y_t in the expression is an endogenous variable vector, x_t is the exogenous variable vector, and ε_t is the error vector. Correlations are allowed between the error variables within the error vector, but autocorrelations between these error variables are not allowed. In the VAR model, the best estimation method for each equation is to use the ordinary Least Square Estimation Method. (Sim 1988.)

4.2 Selection of variables and data

This study uses the daily closing price of the CSI 300 Index to represent China's overall stock price level. Relatively speaking, the CSI 300 Index has more samples than Shanghai Composite Index, and its coverage rate is higher as it covers more than 70% of the market value of the Shanghai and Shenzhen markets, and the representation is better. At the same time, it also has higher liquidity and so it better reflects the overall picture of stock price changes in Chinese stock market. Moreover, the stability of the CSI 300 Index is higher, which avoids the impact of the expansion of the market size due to the issuance of new shares by the SSE Composite Index and SZSE Component Index. The data in this study comes from China Securities Index Co., Ltd.

This study selects the central parity exchange rate of RMB against the US dollar announced by the People's Bank of China daily as an exchange rate indicator. As the

world's largest economy, the U.S. capital market is developed, and the U.S. economy is relatively stable in the world. Therefore, the size of the relative price with the U.S. dollar can also reflect the renminbi's status in the world to some extent. In addition, the U.S. dollar is an international currency that is commonly used around the world and is an important currency for pricing and settlement in the international market. At the current stage, China and most countries use US dollars for settlement when they conduct trades. Therefore, compared with other currencies, the relative price with the US dollar can better represent the reality of our country's currency.

The nominal rate is chosen due to the following reasons. Firstly, the People's Bank of China publishes the central parity nominal exchange rate of the RMB against USD every day, which is of high frequency and authoritative. Secondly, the nominal exchange rate can reflect the supply-demand relationship of funds in the foreign exchange market more directly than real exchange rate. Thirdly, the share price itself will be influenced by inflation inevitably, but the real exchange rate is obtained after the nominal exchange rate eliminates the effects of inflation. Therefore, it is more suitable to do research by adopting a nominal exchange rate. (Dong 2007.)

The CSI 300 index and the exchange rate of the RMB against USD was selected for the duration from 1/4/2006 to 12/30/2016, which are denoted by SM and EX respectively. The sample range includes data on the trading days of the foreign exchange and stock market within the time span and eliminates data that do not overlap in these two markets. The original data includes 2,673 observations.

4.3 Processes of empirical test

4.3.1 Unit root test

In empirical studies, regressions cannot be directly constructed using time series. The reason for this is that if the data is not stationary, it has not been tested for unit roots, nor has it been processed accordingly then it is highly likely that a pseudo-regression will be obtained.

This study uses the Augmented Dickey-Fuller test, known as the 'ADF test'. To clarify whether it is necessary to add intercept items and trend items in the ADF test, the trend chart of share price and exchange rate must first be observed. (Said et al. 1984.)

The trend of the variable SM is shown in Figure 6.

Figure 6. Trend of SM

As can be seen from Figure 6, the intercept of the variable SM is non-zero and should therefore include the intercept term. There is no obvious upward or downward trend. Within the selected time span, China's stock market does not have a clear upward or downward trend, so it should not include trend items. The trend of the variable EX is shown in Figure 7.

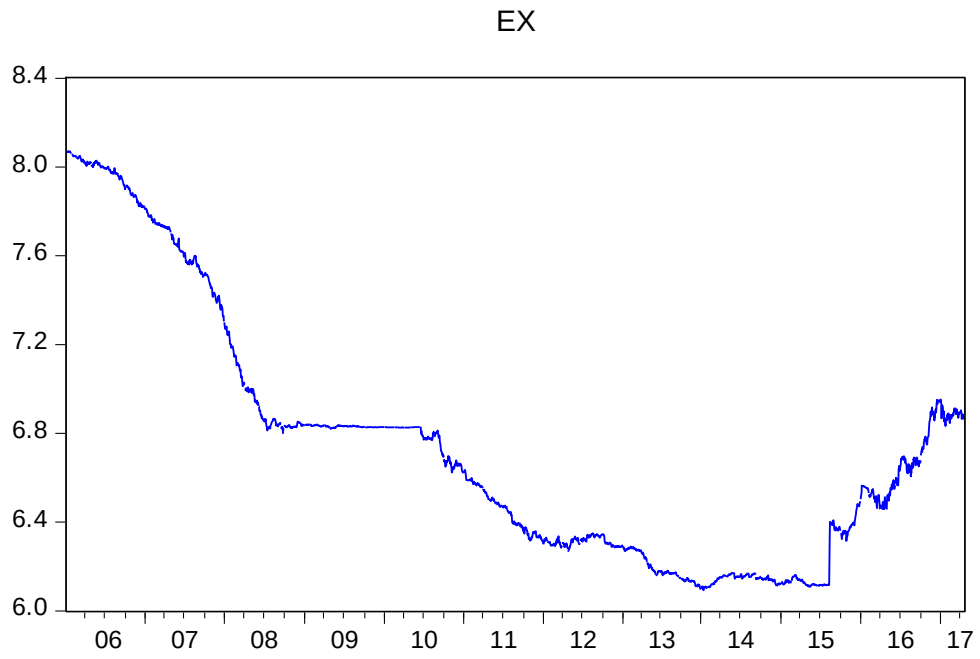

Figure 7. Trend of EX

As can be seen from Figure 7, the intercept of the variable EX is non-zero, so the intercept should be added. The data has a clear downward trend, and from the economic point of view, after the implementation of foreign exchange reform in China, the renminbi also maintains a trend of appreciation, so it should also include trend items. The unit root test results for SM and EX are shown in Table 1.

Table 1. Result of variables SM and EX

Variables	(C,T,L)	t-Statistic	5% level	Prob.*	Results
SM	(C,0,4)	-2.4908	-2.8624	0.1178	non-stationary
EX	(C,T,0)	0.9574	-3.4114	0.9999	non-stationary

Note: The test form is represented by (C,T,L), where C represents whether the test contains an intercept term, T represents whether there is a trend term in the test, L represents the lag length, and L is automatic based on SIC.

A first-order difference for the variables must be made now. The first-order difference result of the variable EX is represented by dEX, and the first-order difference result of the variable SM is represented by dSM. Since the first-order difference can eliminate the trend term, the ADF test for the first-order difference sequence only includes the intercept term and no longer includes the trend term. The choice of lag length is automatic based on SIC. The unit root test results for dSM and dEX are shown in Table 2.

Table 2. Result of variables dSM and dEX.

Variables	(C,T,L)	t-Statistic	5% level	Prob.*	Results
dSM	(C,0,3)	-23.8222	-2.8624	0.0000	stationary
dEX	(C,0,0)	-49.2676	-2.8624	0.0000	stationary

According to Table 1, the variables SM and EX cannot pass the test at the 5% level of significance, that is, they are not stable and there is a unit root. Table 2 shows that after the first order difference is performed on the variable, the corresponding sequence is t-Statistic and the corresponding P-value is 0, far from 0.05. The first order difference between the two variables reaches a steady state at the 5% level of significance, that is, the sequence is monolithic in the first order.

4.3.2 Johansen cointegration test

After a test of stability, it was found that the CSI 300 Index and the exchange rate were in a first-order single state. To study on the long-run correlation between the two variables, a cointegration test needs to be conducted. (Johansen 1991.) Johansen cointegration test was chosen in this section. The test results obtained are shown in Table 3.

Table 3. Results of Johansen cointegration test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.012039	41.99204	25.87211	0.0002
At most 1	0.003197	8.779593	12.51798	0.1944

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.012039	33.21245	19.38704	0.0003
At most 1	0.003197	8.779593	12.51798	0.1944

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

According to Table 3, the cointegration test is mainly carried out by the trace test and the maximum eigenvalue test. The first part is the trace test. From the test results, it is clear that the feature roots exceed the critical value at the 5% significant level, and neither of the two assumptions hold. This violates the statement that no more than one cointegration relationship exists between two single integer sequences. Therefore, there is no obvious cointegration relationship between the CSI 300 Index and the exchange rate. In the second part, the largest eigenvalue test was adopted. The feature roots exceeded the critical value at the 5% significant level. Both assumptions were not true. There was no obvious cointegration relationship between the CSI 300 Index and the exchange rate. In a word, comprehensively, there is no long-run common change trend between the exchange rate and the CSI 300 Index, and there is no long-run equilibrium relation.

4.3.3 Granger causality test

After passing the unit root test, it can be concluded that the two variables are in the first-order monotonic state. Therefore, to identify if each variate is a Granger-cause of another variate, the Granger causality examination is also required for the first-order differential sequence.

The Granger causality test refers to the better prediction of the variable Y if the past information containing the variable X/Y is included. In other words, the X variable can facilitate the interpretation of the Y variable's future changes, and X becomes the Granger cause of Y. (Granger 1980.) This thesis uses a lag of two orders. The results obtained are shown in Table 4.

Table 4. Results of Granger causality test

Pairwise Granger Causality Tests
Date: 04/25/17 Time: 19:57
Sample: 1 2747
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
SM does not Granger Cause EX	2745	0.84083	0.4315
EX does not Granger Cause SM		3.54553	0.0290

As can be observed from Table 4, when the null hypothesis is "SM is not a Granger cause of EX," its corresponding F statistic is 0.84083, and the corresponding P-value is 0.4315, which is greater than 0.05. Therefore, the original hypothesis cannot be rejected under the 5% significance level. Consequently, we cannot regard SM as the Granger cause of EX. On the contrary, when the original hypothesis is "EX is not a Granger cause of SM," its corresponding F statistic is 3.54453, and the corresponding P-value is 0.0290, which is lower than 0.05. Therefore, the original hypothesis is rejected at the 5% level of significance, and EX is the Granger cause of SM.

In a nutshell, a correlation exists between the current value of the share price and the past value of the exchange rate. The exchange rate helps to explain future changes in the stock price, so it can be considered that the fluctuation of the exchange rate is an important

factor that causes the stock market to change. However, in turn, changes in stock prices are not an important factor in making the exchange rate fluctuate.

4.3.4 Choosing the optimal lag length

In order to explore the most suitable VAR model for this set of data, we need to identify the optimal lag order for the set of variables after having conducted the unit root test and Granger causality test. After the judgment, the values of the five evaluation indicators are shown in Table 5. (Serena et al. 2001.)

Table 5. Comparison of the evaluation of each lag order in VAR model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-24819.53	NA	254934.6	18.12452	18.12884	18.12608
1	-5867.026	37863.48	0.249746	4.288445	4.301403*	4.293128
2	-5857.344	19.32905	0.248712	4.284296	4.305893	4.292100*
3	-5849.945	14.75973	0.248096	4.281814	4.312050	4.292740
4	-5846.652	6.563799	0.248224	4.282331	4.321205	4.296379
5	-5835.591	22.03316	0.246948	4.277175	4.324688	4.294344
6	-5834.690	1.793488	0.247507	4.279438	4.335589	4.299729
7	-5828.384	12.54273	0.247091	4.277754	4.342544	4.301167
8	-5820.276	16.11568*	0.246351*	4.274754*	4.348183	4.301289

* indicates lag order selected by the criterion . LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criterion

As shown in Table 5, according to the LR, FPE and AIC criterions, the maximum lag order is 8.

4.3.5 VAR model stationarity test

According to the optimal lag order we evaluated above, the VAR(8) model is used to examine the stationarity and determine whether it is stable. Figure 1 shows the unit circle curve of this model and the specific location of all feature roots of the VAR model. It is not hard to find that the eigenvalues are all within the unit circle. That is, this model is the stationarity and can be discussed in terms of pulse analysis and variance decomposition. (Sim 1988.)

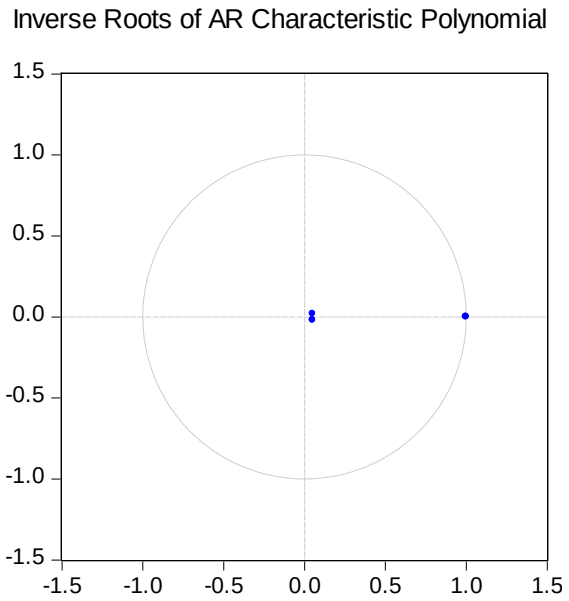

Figure 8. Unit root position map in VAR(8) model stationarity test

4.3.6 Impulse response analysis

After the model is determined to be stable, the short-term equilibrium relationship between variables can be analyzed. That is, the impulse response function of the model is analyzed. Red dashed lines are the 95 % confidence limits of the statistics. The impulse response between the variables are shown in Figure 9. (Kilian 2001.)

The first graph in Figure 9 is the EX's own impulse response. It can be seen that, at the beginning of the period, the impact of EX itself is positive and is relatively large. The second period reaches its peak, after which it declines slightly, but remains basically stable.

The second graph in Figure 9 shows the EX's impulse response to SM. It can be seen that the exchange rate has a positive impact on the stock market at the beginning of the period, peaked at the end of the second period, and then began to decline. And this response is not statistically significant. This shows that in the short term, changes in the exchange rate will cause a rapid response to the stock market, but in the later period the response has slightly weakened.

The third graph in Figure 9 shows the SM's impulse response to the EX. It can be seen from this graph that at the beginning of the period, the stock market had a positive effect on the exchange rate. There was a rapid increase from the first period to the second period,

but the growth was slow at the end of the second period. This response is not statistically significant. This shows that the volatility of the stock market had a rapid impact at the beginning of the period. However, in the later period, the growth rate of this effect has slowed down, but it is still growing slowly.

The fourth graph in Figure 9 shows the SM's own impulse response. It can be observed that its own influence grew rapidly at the beginning of the period and peaked at the end of the second period, but then declined rapidly. However, it remained at a certain positive level at the end of the period.

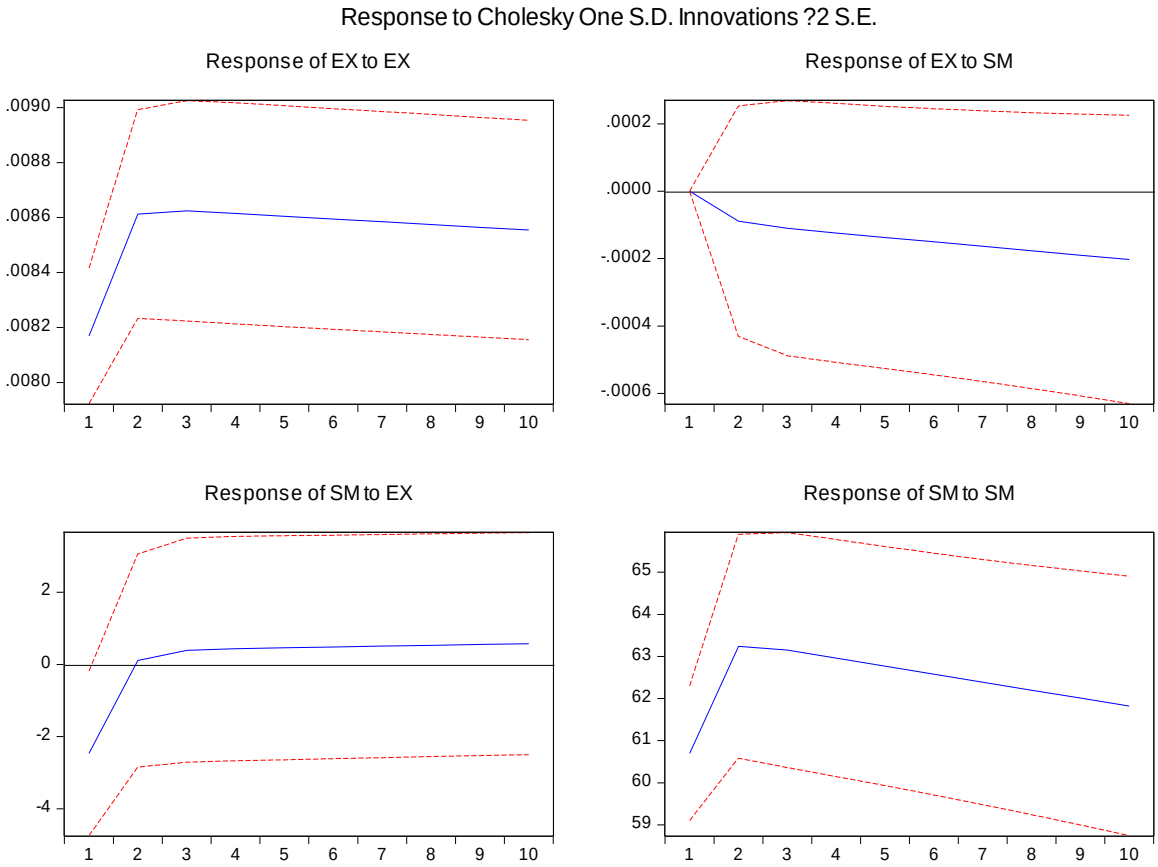

Figure 9. Impulse response analysis graph

4.3.7 Variance decomposition

After performing the impulse response analysis, variance decomposition was performed to study the variance contribution that affect structural shocks of endogenous variables. To a large extent, it can give information on the relative importance of random innovations. This information mainly depends on the degree of variance contribution.

Table 6 shows the variance decomposition of the variable EX. Table 7 shows the variance decomposition of the variable SM. (Campbell 1991.)

Table 6. Variance Decomposition of EX

Variance Decomposition of EX:			
Perio...	S.E.	EX	SM
1	0.008177	100.0000	0.000000
		(0.00000)	(0.00000)
2	0.011882	99.99438	0.005615
		(0.03074)	(0.03074)
3	0.014687	99.99071	0.009286
		(0.04565)	(0.04565)
4	0.017031	99.98780	0.012195
		(0.05397)	(0.05397)
5	0.019086	99.98512	0.014877
		(0.05964)	(0.05964)
6	0.020935	99.98247	0.017525
		(0.06410)	(0.06410)
7	0.022631	99.97978	0.020221
		(0.06795)	(0.06795)
8	0.024204	99.97700	0.023005
		(0.07151)	(0.07151)
9	0.025678	99.97410	0.025898
		(0.07493)	(0.07493)
10	0.027069	99.97109	0.028913
		(0.07834)	(0.07834)

Table 7. Variance Decomposition of SM

Variance Decomposition of SM:			
Perio...	S.E.	EX	SM
1	60.80482	0.164529	99.83547
		(0.15798)	(0.15798)
2	87.77257	0.079104	99.92090
		(0.10857)	(0.10857)
3	108.1624	0.053399	99.94660
		(0.11088)	(0.11088)
4	125.1812	0.041067	99.95893
		(0.11764)	(0.11764)
5	140.0627	0.033876	99.96612
		(0.12320)	(0.12320)
6	153.4305	0.029217	99.97078
		(0.12749)	(0.12749)
7	165.6521	0.025997	99.97400
		(0.13085)	(0.13085)
8	176.9653	0.023673	99.97633
		(0.13357)	(0.13357)
9	187.5351	0.021947	99.97805
		(0.13583)	(0.13583)
10	197.4812	0.020641	99.97936
		(0.13776)	(0.13776)

As can be seen from Table 6, the variance contribution of EX is 100% at the beginning of the period. The variance contribution of EX gradually decreases with the extension of the lag period, and the rate of decline is more balanced. On the contrary, the contribution of the SM variance gradually increases. The rate of increase at the beginning of the period is faster, and the rate of increase in the later period gradually slows down.

In Table 7, with the extension of time, SM's own variance contribution rate increases, the initial growth rate is faster, and the latter part of the growth rate slightly declines. By the tenth period, the variance contribution rate is still 99.9794%. However, there was a slight increase in the early period of EX, but a slight decrease in the latter period. This result echoes the Granger causality test results.

4.4 Empirical findings and analysis of reasons

4.4.1 Empirical findings

This thesis takes China's economic situation as the background, using the middle price of RMB's nominal exchange rate against the USD announced daily by the People's Bank of China as the exchange rate index, and the daily closing price of the CSI 300 Index as the index of China's overall stock price level, selecting the data from 1/4/2006 to the 12/30/ 2016, and drawing some conclusions.

The first point is that from the perspective of a long-run relation, the two variables are not cointegrated, that is, there is no tendency for common changes in the long-run.

Secondly, in the sense of guiding direction, the Granger causality between two variables is one-way, only from the exchange rate to the Shanghai and Shenzhen 300 index, that is, the early variations in the rate of RMB can effectively interpret the changes in the CSI 300. There is little correlation between the current value of the RMB exchange rate and the past value of the CSI 300.

Thirdly, from the perspective of short-term relations, a rapid reflection in the stock market can be observed after variations in the exchange rate, but in the later period the response will be slightly reduced. The impulse responses of the two variables are short-term, long-term fluctuations will tend to zero and restore to the original stable state. They are not affected by the long-term impact due to the impact of the other party.

4.4.2 Analysis of reasons

Although the exchange rate can bring about a certain short-term impact on the stock price, no long-run equilibrium relation can be observed between them. The reason for this is that there are still some factors in our country that restrict the impact of exchange rate on stock prices. The main reasons are as follows:

Firstly, there are still problems with the stock price formation mechanism. In many cases, China's stock price is still seriously interfered with by non-market factors, such as man-made government policies.

Secondly, the level of marketization of Chinese stock market is not high. The share price does not reflect the business' true status and its future prospects. Investors have serious psychological speculation, leading to increased uncertainty in the market, which will affect the normal transmission mechanism between exchange rates and stock prices.

Finally, the development of the foreign exchange market has not been completed. The degree of marketization of the RMB exchange rate is in urgent need of improvement. The capital account has not been fully opened to the outside world, weakening the intermediary role of short-term international capital movements in the process of transmission.

5 CONCLUSIONS

5.1 Main conclusions

In China, the capital market has not been fully opened, nor has it been fully marketized. Some transmission mechanisms between exchange rates and share prices have not been able to function well. In the long run, these two variables of exchange rate and share price are not cointegrated and no evidence of long-term relationship between the two variables was found. From the perspective of short-term relations, the Granger causality between two variables is one-way, and the guiding direction is from the exchange rate to the share price. Moreover, in a short term, it can be concluded that the revaluation of the renminbi has a short-term positive impact on the stock market, and the existence of a time lag is observed.

5.2 Policy recommendations

Firstly, improving the stock price formation mechanism and vigorously developing the stock market (Yao 2009). Then further carry out the reform of the share distribution reform, step by step to establish an open and transparent market trading system, promote the gradual formation of stock market prices, improve the information disclosure system in accordance with the law, and effectively resolve existing problems such as information asymmetry and insider trading (Li et al. 2007). To better boost the growth of the stock market, the function of the stock policy should be weakened, and the role of the stock market in the allocation of resources should be promoted. The construction of supporting facilities in the stock market should be vigorously promoted, the information disclosure work of listed companies should be improved, and the information disclosed by listed company should be supervised, this promotes the continuous improvement of market awareness (Tu 2011). There is also a need to build a multi-level stock market mechanism to promote the optimization and upgrading of market structure, reduce the cost of financing. This will promote better and faster development of China's stock market.

Secondly, perfecting the conductive mediation and guiding psychological expectations (Jiang 2004; Zeng 2012). It is not only necessary to promote the realization of free convertibility under the renminbi capital account, and to ensure the better play of the intermediary role of international capital flows. It is also necessary to guide psychological

expectations in a more rational way and promote the marketization of interest rates in a more active and stable manner. The deposit interest rate ceiling should gradually be loosened to truly reflect the relationship between supply and demand for funds and promote the role of the intermediary to maximize its effectiveness. At the same time, we should also strive to increase the credibility of our government by promoting more transparent information disclosure, encourage investors to form appropriate psychological expectations, increase market information, and prevent psychological fears.

Finally, trading methods and trading tools should be enhanced, comprehensively improving foreign exchange management laws and regulations, and promoting the elasticity of RMB exchange rate (Huang 2012). Further to this, the establishment of a fair competition environment should be facilitated, the formation of a sound RMB exchange rate mechanism should be promoted as well, and the distortionary conception of the RMB exchange rate should be dispelled. These recommendations will all improve the foreign exchange supply and demand relationship.

To achieve better development, China's economy should introduce appropriate international capital, at the same time, it should also provide powerful help for China's financial globalization and liberalization (Xing 2014). In short, China should take appropriate measures to promote free exchange under the renminbi capital project and strive for better and faster internationalization of the renminbi. At the same time, statistical monitoring and early warning of international capital flows should be carried out in a timely manner. Different types of speculative capital and long-term investment capital should be handled differently. The management and restrictions on speculative capital inflows should be increased, direct international investment in China should be promoted, and China's social economy should be promoted. It is hoped that these combined recommendations, founded within my research will, to some extent, encourage comprehensive and healthy development of China's economy.

REFERENCES

/1/ Aggarwal, R. 1981. Exchange rates and stock prices: a study of the US capital markets under floating exchange rates. Akron Business & Economic Review 12, 7–12.

/2/ Ba, S. S. & Yan, M. 2009. The Dynamic Relationship between Stock Prices and Exchange Rates —— Based on the Empirical Analysis of China Market. The Economic Survey of Nankai Economics 3, 46-62.

/3/ Bahmani-Oskooee, M. & Sohrabian, A. 1992. Stock Prices and the Effective Exchange Rate of the Dollar. Applied Economics 24, 459-464.

/4/ Campbell, J. 1991. A Variance Decomposition for Stock Returns. The Economic Journal 101, 405, 157-179.

/5/ Chen, Q. M. 2012. Research on the Scale of International Short-term Capital Flow and Its Impact on Macroeconom. Economist 10, 31-39.

/6/ Chen, R. F. 1999. On the Interaction and Influence of Exchange Rate and Stock Price. Theory and Practice in Finance and Economics 2, 54-57.

/7/ Deng, S. &Yang, C. J. 2007. The relationship between the Chinese stock market and the foreign exchange market after the exchange rate reform —— an empirical study of the RMB exchange rate and Shanghai Composite Index. Finance Research 12, 55-64.

/8/ Dong, Z. X. & Zhou, B. 2007. The Empirical Research of Interest Rates' Influences to Consuming, Investment, Stock Price and Rate of Exchange. Journal of Adult Education of Hebei University 9, 4, 104-106.

/9/ Dornbusch, R. & Fisher, S. 1980. Exchange rates and the current account. American Economic Review 70, 5, 960-971.

/10/ Fan, Z. J. & Long, S. H. 2006. Relationship between RMB Exchange Rate and Share Price. Journal of Guangxi University 6, 39-42.

/11/ Feder, G. 1982. On Export and Economic Growth. Journal of Development economics 12, 63-87.

/12/ Frankel, J. A. 1983. Monetary and Portfolio Balance Models of Exchange Rate Determination. Cambridge. MIT Press.

/13/ Gordon, M. J. 1959. The Review of Economics and Statistics. 41, 2, 99-105.

/14/ Granger, C. W. J, Huang, B. N. & Yang, C. W. 2000. A Bivariate Causality Between Stock Prices and Exchange Rates: Evidence from Recent Asian Flu. The Quarterly Review of Economics and Finance.

/15/ Granger, C.W.J. 1980. Testing for causality: A personal viewpoint. Journal of Economic Dynamics and Control 2, 329–352.

/16/ Hirshleifer, D. & Teoh, S.H. 2003. Herd behavior and cascading in capital markets: A review and synthesis. European Financial Management 9, 1, 25–66.

/17/ Huang, R. 2012. Analysis of Influence of Money Supply on the Stock Price Index in Autoregression Model. Statistics & Decision 6, 23-28.

/18/ Hyde, S. 2007. The response of industry stock returns to market, exchange rate and interest rate risks. Managerial Finance 33, 9, 693-709.

/19/ Ji, X. D. 2004. The Impact of Short-term Capital Flow on China's Economy. Shanghai Finance 7, 42-43.

/20/ Jiang, J. F. 2004. The Mechanism of Foreign Direct Investment in China's Economic Growth. World Economy.

/21/ Johansen, S. 1991. Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica 59, 6, 1551–1580.

/22/ Kasman, S., Vardar, G. & Tung, G. 2011. The impact of interest rate and exchange rate volatility on banks' stock returns and volatility: Evidence from Turkey. Economic Modelling 28, 3, 1328-1334.

/23/ Kilian L. 2001. Impulse response analysis in vector autoregressions with unknown lag order. Journal of Forecasting 20, 161-179.

/24/ Li, Z. G. & Gao, M. S. 2007. The linkage effect of stock price and exchange rate after the recent exchange rate system reform. Modern Finance and Economics 10, 7-12.

/25/ Lin, C. H. 2012. The comovement between exchange rate and stock prices in Asian emerging markets. International Review of Economics and Finance 22, 1, 161-172.

/26/ Liu, B. & Liu, X. 2011. The dynamic relationship between RMB appreciation expectations and China's stock market. Economic Survey 4, 145-149.

/27/ Mao, C. K. & Kao, G. W. 1990. On exchange rate changes and stock price reactions. Business Finance & Accounting 17, 3, 441-449.

/28/ Muhammad, N., Rasheed, A. & Husain, F. 2002. Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries. The Pakistan Development Review 41, 4, 535-550.

/29/ Mundell, R. A. 1963. Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economic and Political Science 29, 4, 475–485.

/30/ Richard M. L. 2002. International Financial Markets Prices and Polices. Education.

/31/ Said, S. E. & Dickey, D. A. 1984. Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order. Biometrika. 71, 3, 599–607.

/32/ Serena, N. & Pierre, P. 2001. Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power. Econometrica 69, 6, 1519-1554.

/33/ Sims, C. 1980. Macroeconomics and Reality. Econometrica 48, 1, 1-48.

/34/ Soenen, L. E. & Hennigar. 1988. An Analysis of Exchange Rates and Stock Prices: The US Experience between 1980 and 1986. Akron Business and Economic Review 19, 7-16.

/35/ Solnik, B. 1987 Using Financial Prices to Test Exchange Rate Model: A Note. Journal of Finance 42, 141-149.

/36/ Tu, J. W. 2011. Research on the Impact of RMB Exchange Rate Appreciation on China's Stock Price. Southwestern University of Finance and Economics.

/37/ Vardar, G., Aksoy, G. & Can, E. 2008. Effects of Interest Rate and Exchange Rate on Volatility and Return of Sector Price Indices at Istanbul Stock Exchange. European Journal of Economics 11, 126-135.

/38/ Wang, A. J. & Zhang, Q. W. 2003. Linkage between exchange rate and interest rate under different economic systems. Modern Finance 9, 12-15.

/39/ Wang, W. & Jiang, L. 2003. Analysis of the Advantages and Disadvantages of RMB Appreciation to China's Stock Market. Journal of Hubei Finance and Economics College 12, 41-43.

/40/ Xing, L. W. 2014. Effect of RMB appreciation and internal depreciation on China's securities market —— An empirical analysis based on securities price and RMB exchange rate. Times Finance 10, 113-115.

/41/ Xu, J. 2008. Research on Exchange Rate Transmission Mechanism of Monetary Policy and Influence of Stock Market on it. East China Normal University, 11-18.

/42/ Yao, X. W. 2001. Chinese exchange rate and asset price transmission mechanism. Zhejiang Finance 1, 81-85.

/43/ Yun, C. 2009. RMB exchange rate, asset prices and short-term international capital flows. Economic Management 1, 1-6.

/44/ Zeng, S. J. 2012. An Empirical Analysis of Herding Effects of RMB Foreign Exchange Market based on GARCH and EGARCH models. Business Economics Research 4, 42-43.

/45/ Zhang, B. & Feng, S. X. 2008. The Relationship between Exchange Rate and Stock Price: An Empirical Study Based on Data after Exchange Reform. Economic Research 9, 71-80.

/46/ Zhou, H. Q. & Li, Y. L. 2010. Research on the Relationship between RMB Exchange Rate and Stock Price under the International Financial Crisis. Studies of International Finance 8, 69-76.